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1982 DOE AUTHORIZATION
(Program Review)

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HEARING

BEFORE THE

SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND COMMUNICATIONS

OF THE

COMMITTEE ON SCIENCE AND TECHNOLOGY U.S. HOUSE OF REPRESENTATIVES

NINETY-SIXTH CONGRESS

SECOND SESSION

SEPTEMBER 30, 1980

[No. 148]

Printed for the use of the
Committee on Science and Technology

U.S. GOVERNMENT PRINTING OFFICE
69-031 O WASHINGTON : 1980

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1982 DOE AUTHORIZATION

(Program Review)

TUESDAY, SEPTEMBER 30, 1980

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON TRANSPORTATION, AVIATION
AND COMMUNICATIONS,
Washington, D.C.

The subcommittee met, pursuant to notice, at 9:40 a.m., in room 2325, Rayburn House Office Building, Hon. Tom Harkin, chairman of the subcommittee, presiding.

Mr. HARKIN. The Subcommittee on Transportation, Aviation, and Communications will come to order. Today the subcommittee begins the process toward a fiscal year 1982 DOE transportation programs authorization.

As most everyone knows by now, the subcommittee conducts two series of hearings each year. The first, which we are starting today is a program review of DOE's ongoing activities.

We plan to evaluate carefully the progress that the Department has made in their transportation programs during the past 12 months.

Next February, the second phase will consist of a detailed review of DOE's fiscal year 1982 budget request.

Then based on the results of these hearings, the subcommittee will develop legislation to authorize the DOE program for 1982.

Mr. Royer?

Mr. ROYER. No, thank you.

Mr. HARKIN. Our sole witness today is Dr. Maxine Savitz, Deputy Assistant Secretary for Conservation, Department of Energy, Washington, D.C.

Dr. Savitz, we have a copy of your prepared statement and without objection it will be made a part of the record in its entirety.

STATEMENT OF DR. MAXINE SAVITZ, DEPUTY ASSISTANT SECRETARY FOR CONSERVATION AND SOLAR ENERGY, DEPARTMENT OF ENERGY, ACCOMPANIED BY MR. HENRY STADLER

Dr. SAVITZ. Thank you, Mr. Chairman.

I am accompanied today by Dr. Henry Stadler who is the head of the Office of Transportation Programs. As you suggested, I will make the whole statement a part of the record, and just want to highlight some of the parts of it and give a progress report on some of the ongoing things that have occurred over the past year.

In doing that I will describe some ongoing projects in each of the four program areas of the Office, the Advanced Technology Development Division, the Electric and Hybrid Vehicles and Transportation Utilization Divisions.

As you are aware from past Department of Energy testimony given on the automotive technology development program, the major focus of our ongoing activity is a systematic development and demonstration of two advanced automotive heat engines, the Stirling and gas turbine. They offer high potential for future petroleum conservation as well as multifuel capability.

Two elements of the advanced heat engine program, the turbine and Stirling engine, have been elevated to the status of major systems acquisitions within the Department. These are 2 of only 37 programs within the Department to recieve this status, which means they get regular review by the Under Secretary and also the Deputy Secretary, so that there is a high level of visibility and interest in these programs in management taking an active part in some of the major milestone decisions.

In the past year both the turbine and the Stirling developments have progressed at a development rate which is on schedule with the normal technical risk. In the turbine area two teams of automotive industry participants have been pursuing their individual concepts and have completed their mod I design.

The AiResearch/Ford team is pursuing a single-shaft turbine concept. The vehicle integration of the contract has shown that this engine can be configured in the latest downsized, front wheel drive Erica body style, which is being introduced this model year in the Ford Escort and Mercury Lynx and will be representative of a major portion of Ford's future production.

The General Motors team is at a similar point in their development, having completed the preliminary design of a two-shaft gas turbine. The vehicle integration tasks indicate that the engine and drive train can be accommodated into the X body, front wheel drive automobile. This program will demonstrate this capability in a 1982 Pontiac Phoenix.

In addition as a result of the fiscal year 1980 Interior appropriations bill, which added $7 million for a third turbine development team, we've modified an existing Chrysler contract to include their participation in preliminary design of a third automotive turbine using a belt drive continuously variable transmission.

During the past year, the gas turbine program has been able to make significant progress toward meeting its goals in some of the following technical areas:

Initiated hot tests on ceramic parts at Detroit Diesel Allison for the 2,070° engine configuration of the ceramic applications in turbine engines project. The ceramics are a key to making the program successful. There can be spinoff into some of the other heat engine programs such as the Stirling.

The Stirling program is also progressing well. The Mechanical Technology, Inc., United Stirling, and AMC team has completed, on schedule, the mod I engine design and procurement of engine system hardware.

A strike in Sweden has delayed by about 1 month the delivery of the first engine; however, it is anticipated that the first mod I engine

will start assembly testing in November 1980, and the first engine dynamometer performance testing will begin in February 1981.

The mod II version of the engine, which has gone through preliminary design and vehicle intergration studies will be demonstrated in a 1982 GM X body Oldsmobile Omega.

Based on preliminary estimates we anticipate fuel economy on the EPA combined driving cycle would be 48 miles per gallon, using diesel fuel, which is about double what you get now.

The vehicle systems program is continuing work on improving present-day and advanced vehicle systems. The organic Rankine bottoming cycle development—(waste heat recovery)—has been demonstrated in a class 8 Mack truck for 1 year with a consistent showing of a 10-percent improvement in fuel economy over a conventional diesel driven truck.

A turbocompound heavy duty diesel has also completed 1 year of operation in revenue service between California and Florida, accumulating over 50,000 miles. This is a major accomplishment both in accumulating the miles and showing that a continual 5-percent improvement is attainable with the waste heat recovery equipment. Cummins Engine Co., contracted to supply this system, is presently looking at downsizing the engine horsepower and manufacturing a turbocompound system in the mid-eighty's.

In the alternative fuels utilization program we assess an appropriate look at the readiness of alternative fuels for transportation through understanding and solving the problems associated with upgrading crude supplies and matching them to the appropriate engines.

Laboratory tests of 100-percent methanol and ethanol fuels have been completed. And these can serve as a basis for design of an optimized commercially oriented vehicle.

Continuing work on the use of straight methanol now involves an operational fleet of 10 vehicles using several fuels management systems. These go beyond those commercially used in Brazil and provide the basis for achieving U.S. needs which are more complex due to factors such as emission regulations.

The major effort in alcohol fuel reliability testing will continue in fiscal year 1981. Controlled fleet vehicle testing on engineered methanol gasoline blends will be completed. Feasibility investigations on the practicality of using ethers from coal in alcohol blends will also be completed.

In parallel with the efforts on alcohols, technical activities in the area of synthetic fuels and hydrogen will continue. We will do a major assessment of the technical issues and resource economics of using gaseous fuels such as methane in this current year and we will complete this assessment about 6 months from the initiation of the project.

Earlier this year we initiated a project to evaluate a wide range of fuels representing shale- and coal-derived fuels in internal combustion engines that represent five different combustion chamber designs. Generally we are moving from just doing alcohol fuels to the synthetic fuels, particularly as gasohol comes more on the market and is more of a commercial product.

The aim of the synthetic fuel testing is to identify the first generation approach for an optimized synfuel engine system, so when synthetic fuels are being produced the end of the 1980's the engine and fuels will match.

Compared to making gasoline from coal, an optimized system could have one-quarter to one-half of the coal feedstocks required per vehicle-mile traveled.

The third major program area is the electric and hybrid vehicle program. Since our presentation to the committee last year, there's been an increased interest in public awareness in electric vehicles, due to rising fuel costs, concern over the availability of petroleum and the press release by General Motors and Gulf and Western. General Motors and Gulf and Western have announced their intent for serious development effort and commitment to production of electric cars and batteries.

Although both companies have stated a number of milestones must be attained before introduction of electric cars and the new battery to the consumer, the activities of the two companies represent a serious effort to commercialize electric vehicles.

On September 5 Globe Union publicly announced it will begin commercial production of a new lead acid battery, the Globe EV–1000, for electric vehicles. It is the same battery that was developed for our near-term electric vehicle, the ETV–1.

The demonstration program is also making progress in assisting industry decisionmakers on the economic viability of electric vehicles in fleet operation. Many of our site operators are ordering additional vehicles. One of the largest supporters has been the General Telephone and Electronics, GTE. They are negotiating with us to place vehicles at several new locations across the country in addition to the three they already have.

Cliff Hayden, the energy director for GTE, has made this comment and statement:

> It is my considered opinion based on the knowledge gained to date from the DOE electric and hybrid demonstration program, our projections of future liquid fuel costs coupled with fuel uncertainties, that the electric vehicle can be economically justified at a selling price approximately 1½ times the cost of a comparable internal combustion vehicle.

We think comments such as Mr. Hayden's and actually the future continual orders demonstrate the beginning acceptance of the electric vehicle.

To achieve the goal of commercialization of electric and hybrid vehicle technology the Department's programs have focused on five projects to accomplish specific objectives.

The market demonstration project—the purpose of this activity is to identify, test and expand electric and hybrid market sectors and to develop the necessary support infrastructure to maintain vehicles in practical operation.

Demonstration site operators, interacting with manufacturers, have caused improvements in electric vehicle performance, safety and reliability. Based on cost-sharing agreements initiated by site operators, 5 vehicles with advanced batteries such as zinc chlorine are being contracted for in this current fiscal year and up to 10 in the next fiscal year.

The new private sector partners in the cost-sharing ventures include taxi operations in New York City, dealer type operations in New Jersey and Colorado, and major airlines.

State and local government participants have increased from 10 to 22; and more than 850 new requests for applications have been received for participation in fiscal year 1981.

Once negotiations are complete with companies selected in the private sector, some 75 cost-sharing site operators will be involved in 97 different locations. And 1 company alone will have 185 vehicles at the 10 locations. The site operators are beginning to feel that EV's can compete with the internal combustion engine without subsidy in some of their fleet applications.

The second part of the program is the incentive program. Loan guarantees have been awarded to two manufacturers. Electric Vehicle Associates of Cleveland received a guarantee of about $2.5 million. And then Jet Industries received a $3 million loan guarantee this month.

During fiscal year 1980 several additional loan guarantees were submitted and these are being reviewed.

As an additional incentive to the major auto manufacturers, Congress passed legislation in 1980 to permit the use of an equivalent miles per gallon for electric vehicles in the corporate average fuel economy standards. A proposed rule for the method of calculating the electric vehicle mpg equivalent was published in the Federal Register in May of 1980. A final rule is scheduled for this December which is our due date for that.

The third part of the program is the vehicle evaluation and improvement project. The objective of this project is to develop improved vehicles through optimization of off-the-shelf technology to aid the rapid commercial availability of these vehicles.

Eleven additional vehicles were procured under the product improvement activity and were delivered for testing. Six of these vehicles will enter field test programs being conducted by TVA.

We have initiated an activity to develop an air-conditioning unit suitable for use in electric vehicles, utilizing off-the-shelf components.

The fourth area is the electric vehicle commercialization project. The purpose of this is to induce mass production by 1986 of cost competitive cars that will be acceptable to a broad segment of the market and to expand technological options to the EV industry. Part of that effort is the commercialization of the batteries.

Testing of experimental nickel-zinc, nickel-iron and lead-acid battery modules at the Argonne National Laboratory National Battery Test Lab indicated achievement of the 1980 goals in energy, power, and life.

Installation of a zinc-chloride battery in an electric vehicle is well under way by Gulf + Western's EDA Corp. We will begin the testing of those vehicles.

A one-of-a-kind facility for programable testing of electric and hybrid vehicle propulsion systems components, called the Road Load Simulator, became operational and is enhancing our low cost, high quality testing capabilities.

Another area in the electric and hybrid vehicle is the hybrid vehicle commercialization project. We want to stimulate the commercialization of a hybrid-powered car by the late 1980's so that we will have a range and acceleration performance equivalent to conventional vehicles but with a 40- to 70-percent reduction in fuel consumption.

Phase I preliminary design studies were completed by four contractors. General Electric was selected to continue into the phase II vehicle development. They will build two hybrid integrated test vehicles for delivery in the spring of 1982.

Advanced hybrid propulsion system studies completed by three contractors, identified propulsion systems that would be suitable for five different classes of vehicles using technology that could be developed by the mid-1980's.

And the advanced vehicle development project hopes to develop by the early 1990's a general purpose electric or hybrid vehicle completely competitive with the internal combustion engine vehicles, requiring no petroleum for operation.

One of the accomplishments of the past year was the technology fabrication for dynamic testing of inductive coupling in electrified roadways which is almost completed by Lawrence Livermore Laboratory and dynamic tests will be conducted next year to fully characterize the system.

Due to the transportation system and multiple applications of this concept it is being conducted in cooperation with the Department of Transportation.

The annual report and quarterly reports, with more detailed description of the progress of the EHV program have been forwarded to the Congress. The most recent one covers the period April thru June. It has just been published and we have made it available at this hearing.

The fourth area in the Office of Transportation programs is the transportation utilization program which really includes the Department's activities to foster the acquisition of the most efficient transportation equipment available in the marketplace, the operation and maintenance of vehicles and equipment in a manner that maximizes energy efficiency.

And the goals are to reduce consumption in the near term to levels consistent with the national goal of reducing our dependence on imported petroleum. One part of this program is the issuing of the fuel gas mileage guidelines. And approximately 16 million copies of these are distributed and printed annually in order to provide buyers with the most useful and informative information on energy efficiency.

Another part of this program is the driver energy conservation awareness program. And this year this program had a series of teach-ins held in major cities around the country. It was featured as part of a White House Energy Efficiency Conference conducted by the President in April. The White House has had several conferences related to energy conservation. The first one it had was related to transportation.

As part of this many requests were received, over 600 requests from industry for information on the driver awareness training program. And over 1,000 teach-in participants were trained in 8 major cities with regard to establishing gasoline conservation training programs for their organizations and constituents.

The program also has graduated about 2,000 drivers from its driving classroom course and developed over 250 new instructors. And these instructors are initiating DECAT programs in different localities across the country. Many of the who people participate are State and local police. We've had comments from people such as the commander of the Maryland State Police who has estimated that the training program will save 14 percent of their fuel and will pay for itself within the first few months of operations. And savings will continuously accrue with more people becoming aware of the advantage of driving appropriately.

This program also has a nonhighway transportation program concerned with developing and commercializing technology for marine, pipeline, and railroad modes of transportation. This year it completed the design and assessment of the application of organic Rankine bottoming cycles to marine diesels and initiated procurement action to establish an industry Government cost shared program.

Another aspect of this program is helping with and working with the provisions of the energy emergency conservation act of 1979. The program has developed a methodology for establishing State gasoline conservation targets, has issued voluntary targets to each State for all four quarters in 1980. The purpose was to familiarize the States with the methodology and the data base used in developing targets, to impress upon the States the need to reduce their levels of consumption and also to impress upon them trying to start to initiate plans statewide in case there are emergencies.

This program has also provided transportation components of the Federal standby emergency conservation plan which was published last February and participated in the public hearings around them.

In the current fiscal year we continue to place emphasis on development and assessment of continued planning measures in support of improving the development of the data base and reporting system for gasoline fuel use. There will also be continual effort to get better data and more timely data.

Another effort in the current year is to go along with the driver improvement effort in looking at feedback devices for retrofit in the new automobile market and to see about testing these and how much that will gain in energy saving.

We will increase the gas mileage guide dissemination by 4 million copies and we'll continue to conduct evaluation programs.

In summary, I want to say that the activities of the transportation program cover a broad spectrum of programs to conserve energy and reduce petroleum dependence that range from information types of programs to technology development as in the heat engine and the electric vehicle, leading to commercialization programs.

I think it is one of the most exciting programs we have in the Department. It is also exciting to see the results being accumulated as we go along.

Thank you.

Mr. HARKIN. Thank you, Dr. Savitz.

Let me just ask you, in the Division for Conservation and Solar Energy how many people do you have working?

Dr. SAVITZ. In conservation generally 630 is the authorized number of slots.

Mr. HARKIN. I just wonder how many people do you have working under the heading where you are Deputy Assistant Secretary for Conservation.

Dr. SAVITZ. That includes 287.

Mr. HARKIN. How many of those work in the automotive area?

Dr. SAVITZ. The transportation program has 57 direct people.

Mr. HARKIN. That is both the heat engine and electric?

Dr. SAVITZ. Those and the transportation systems utilization program. The total of transportation programs include a staff of 57.

Mr. HARKIN. Fifty-seven out of 287 is about 1 out of 5 in conservation for transportation. Which sector of our society uses the most

petroleum? In terms of making the biggest indentation, it seems to me that conservation should be emphasized in transportation

Dr. SAVITZ. The transportation sector uses 52 percent, or half of the Nation's petroleum.

Mr. HARKIN. So under conservation in the Department of Energy we have one out of five there working on transportation conservation.

Dr. SAVITZ. I think one of the things to consider, though, is that the transportation program, unlike some of the other programs under my auspices such as the buildings program, does not have any regulatory type of activities, which I think is a positive aspect of the transportation program. In the near term type of activities related to fuel economy mileage—that is, the CAFE standards—we have responsibilities for the guidelines but we don't have responsibilities for that whole aspect of transportation fuel economy regulation which affects the near term savings.

Mr. HARKIN. You have responsibility for research and development, don't you?

Dr. SAVITZ. We do.

Mr. HARKIN. How much money was appropriated in this last fiscal year for conservation, this fiscal year we are in right now?

Dr. SAVITZ. $370 million.

Mr. HARKIN. How much of that for transportation?

Dr. SAVITZ. $113 million.

Mr. HARKIN. Do you feel that the transportation sector of conservation is up to speed? Do you feel that is a good mix? Do you feel that given the need for conservation in our country and the impact that transportation has on our use of nonrenewable energy resources, do you feel that that $113 million out of $370 million represents a good fraction of the amount of money spent under your division; and the 57 people out of 287, do you feel that is appropriate?

Dr. SAVITZ. I think the $113 million provides us with a good mix of activities that it should in research and development and commercialization long-term activities we are starting more and more to try to lever that money with private sector involvement.

I think the whole conservation effort is understaffed. Let me be clear on that. And, consequently, we have had to implement a procedure of decentralized management. I think the transportation program has been one of the most effective in fuctioning with that type of decentralized management.

Mr. HARKIN. Excuse me, Dr. Savitz. How many people are you authorized in the Division of Conservation?

Dr. SAVITZ. The 287.

Mr. HARKIN. Are you up to authorized levels?

Dr. SAVITZ. This month we received temporary relief from the freeze and we've been able to hire people. The transportation people were able to hire 6 of their 8 vacancies to bring them up to 55 in this past month.

Mr. HARKIN. Mr. Taylor here was saying that there are a lot of people in NASA who work in this area.

Dr. SAVITZ. Yes. That is what I was referring to as the decentralized management. And this program has effectively asked NASA to help with the program management in view of the fact that we haven't been able to have our own staff and the numbers have not increased.

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Mr. HARKIN. As you know, I have a great interest in the Stirling engine. I have been following it for a number of years. My interest centers around its capacity for using alternate fuels. I just wonder what do you see as the most significant technical problems yet to be solved in the Stirling Engine project?

Dr. SAVITZ. I think we have to show that it will really perform and get the mileage that is currently estimated. The 48-mile-per-gallon. fuel economy has to be demonstrated in a vehicle as well as vehicle reliability. Time is needed to achieve the 48-mile-per-gallon performance we think it can have and to show that in a reliable fashion.

I think even more than the technical problems are some of the economics; the engine cost of the components and being able to assemble these has to be addressed so that we can get a vehicle that will be competitive with the existing type of equipment.

Mr. Stadler may want to add a few things.

Mr. STADLER. I think those are the two principal problems. The cost problem, of course, in competing with existing internal combustion engine manufacturers is very severe, because there has been a great deal of development of cost-cutting techniques in the production of the conventional engine. That's a terribly difficult thing to do.

Mr. HARKIN. How would you use the additional $5 million for a second Stirling team, if the money were appropriated?

Dr. SAVITZ. Our thoughts for that and our planning for doing it would be to use it to build up some of the technology development aspects, work on the power train part of the program, look at manufacturing of various components, looking at some of the fluid components rather than try to build a second team that could get on the same schedule as MTI.

We think it could help accomplish the component development work and lead toward the manufacturing which will help aid the commercialization of Stirling in this country where there is currently no manufacturing capability for the Stirling technology. The administration has supported your $5 million increase in that effort to do this sort of component technology development and see it as a potential for a 3-year type of effort.

Mr. HARKIN. I understand that—I believe it was NASA that went out into Commerce Daily with a request—or was it you?

Dr. SAVITZ. We went out with a request for sources sought to see what people would be interested in participating in that program, to look at the potential strategies and who might be interested.

Mr. HARKIN. How many replies did you get?

Dr. SAVITZ. Thirty replies.

Mr. HARKIN. Are you evaluating those now?

Mr. LOMBARDI. As an expression of interest we moved to give all the people who came to NASA the benefit of what we had attempted to plan for the following year. We really can't do anything until fiscal 1981 in terms of an RFP; but we did get an expression of interest from 30 corporations.

Mr. HARKIN. We have some varying statements about the level of Ford's interest in getting back into the Stirling program. Would you like to comment on that?

Mr. STADLER. My understanding is that Ford Motor Co. would be interested in developing components but that they do not care to go

into an engine development even if the Government were prepared to finance one. Is that the sort of question you wanted answered?

Mr. HARKIN. Yes. But are they not interested in getting into the engine development?

Mr. STADLER. I think they feel that in the same fashion that they had to give it up before that their engine people are so much in demand for other activities that they couldn't really put together a good team.

Mr. HARKIN. Are they still saying it is too long term?

Mr. STADLER. I haven't heard that statement.

Mr. HARKIN. I thought I heard that statement from Ford 2 years ago.

Mr. STADLER. I suppose that in some sense it is longer term than some of the things their people are working on. They are working very hard on a lean burn concept which I think is soaking up a great deal of their engineering effort. That is shorter term than the Stirling engine. I think they think the Stirling engine is a promising midterm engine but not an engine that they would expect to be manufacturing in the mideighties and the leadtime would mean that right now they would not be able to spare the manpower for that. I think they are having a hard time sparing the manpower.

Mr. HARKIN. So, they are only interested in the components. That's interesting.

Mr. STADLER. They are stating an interest in looking into various programs with us, not just the Stirling but they are certainly interested in the component side of the Stirling.

Mr. HARKIN. I am just concerned about the progress on the Stirling engine. I think in your statement you said that Stirling of Sweden was about to come up with their MOD-II pretty soon.

Mr. STADLER. MOD-I is what they call it. It is actually the MOD-II. They have previously made the P-40 engine and this is the first engine—the MOD-I is the first one they have made on our support as part of this program.

Mr. HARKIN. It is designed specifically for automobiles?

Mr. STADLER. Yes; it is the first one designed for an automotive engine.

Mr. HARKIN. How soon will it be built and when will it be in a car?

Dr. SAVITZ. They should start assembling next month and performance testing begins in February 1981.

Mr. HARKIN. Who is assembling it?

Mr. STADLER. I believe that is being——

Mr. LOMBARDI. There were seven engines in the MOD-I build. The first two or three engines would be built up in Sweden and then sent to the United States. The latter part of the first build would be done by MTI, in the United States.

Mr. HARKIN. When?

Mr. LOMBARDI. First engines would be delivered to the United States in January 1981. They will go through some testing and then in the latter part of 1981 will go into vehicles.

Mr. HARKIN. How will it be different from the engine in the car you have out there today?

Mr. LOMBARDI. The MOD-I engine, as Dr. Stadler said, is the first engine that has ever been constructsd based on an automotive

application, and it is designed specifically for good performance and high efficiency at part load.

The P–40 engine which is in the vehicles we demonstrate now is a laboratory engine designed for constant speed at its design point. Since the EPA drive cycle is not at constant speed, this engine should perform quite a lot better on the EPA drive cycle. That's basically it.

Mr. STADLER. There's also a difference in size, isn't there?

Mr. LOMBARDI. There's a small difference in size. The weight-to-power ratio is 14 pounds per horsepower for the P–40 and the MOD–I engine would be 7 pounds per horsepower. The MOD–II will be in the neighborhood of 3.5 pounds per horsepower, which is the same weight as the conventional automotive light duty diesel. Those are the goals of the program.

Mr. STADLER. Since the P–40 was designed for stationary applications, no concern was given to the things that would affect your designing for a vehicle. You are very conversant with this, of course.

Mr. HARKIN. I would like to just talk briefly about the hybrid vehicles. People tell me that it looks like we're not really doing enough hybrids, that we're doing enough on heat engines and on electric but not enough on the hybrids themselves.

Do you feel we are doing enough work on the hybrid program itself? Let me rephrase that. Do you think that the hybrid program itself is one that is going to make some promising payoffs or should we go down two different roads, just strictly electric and heat.

Dr. SAVITZ. I don't think we are ready to make the decision as to strictly electric or strictly hybrid. Some people have made the comment that what you do with the hybrid is put all of the problems of both engines together and it doesn't simplify but makes it more complicated.

I think the program we have of trying to design a hybrid vehicle and see how it performs is appropriate. The disadvantage of what we have in the program now is we have only one system going ahead, the GE one, so there is no competition to see what are the other possibilities. There is always more risk when you are looking only at one approach rather than two. I think it has to be continued.

Mr. STADLER. I would like to add to that, if I may. One of the problems about hybrids is there are so many parameters that one can alter and choose from in a design that it gets to be a very difficult problem to get hold of. We have felt that an appropriate way to clarify some of this is to use what is called a mule car.

I think you are aware of the concept that one tests out a good many concepts before getting to an actual vehicle prototype to build. I think that would be a very desirable addition to this program and would allow us to do a combination of computer studies and verification of those that would clarify the benefits and costs of different possible hybrid manifestations much better than we have been able to in the past. I believe also the auto industry is in general agreement with that proposition. We are in the process of proposing that sort of a route.

Mr. HARKIN. Mr. Royer?

Mr. ROYER. Dr. Savitz, I wonder, first of all, just generally, could you tell me do we have some kind of a compact plan that we are working on to meet some certain specified goals? I am thinking in the short range and maybe midterm and long term.

The thing that concerns me a little bit—and I say this with mixed emotions, because I think we should be exploring as many alternatives as we possibly can—is that we are doing a lot of things and I'm just wondering if we have selected specific areas that we feel will do the most amount of good in the shortest period of time for the short term plan and then our midterm and our long term? Do we have something down compact that we can look at where we have goals?

Dr. SAVITZ. We have put out every year a 5-year plan that states our goals and states the program we are using to meet those. And then for some major programs such as the gas turbine engine and Stirling engine and the electric vehicle we have major separate program documents that go a little more detailed as to its milestones and goals as a way of seeing how we are progressing. I think the program has the right balance in focusing initially on the automobile. And that was a decision that was made that uses the most energy in the sector and the straight petroleum. And so consequently the development of the heat engine and then the electric vehicle as a substitute for getting off electricity are the major programmatic parts of the program.

Another one that has been increasingly emphasized and has achieved increased support for energy conservation in the near term is our program which gives out fuel-economy information; our driver awareness and driver training programs, these promote things which people can do right now and don't involve waiting for a future technology in trying to promote fuel economy.

So there is very much a balance of the nearterm activities leading toward information and driver training and driver awareness.

Mr. ROYER. Let me ask you this: What is your judgment as far as the heat engine is concerned? Is that anticipated to be in the short term?

Dr. SAVITZ. That is something that we are looking into for the late 1980's and 1990's.

Mr. ROYER. The reason I ask the question is because I asked it last year when we looked at the proposal which indicated you were going to have three teams developing in this area and now I see that you are recommending the third one. It concerns me a little bit that we are duplicating and maybe that's not the case. But I was concerned about it a year ago when we talked about it, and I'm still concerned today, because it seems to me that those funds could be used better in some of the conservation programs that the chairman spoke of. You spoke of increasing the mileage and so on. I don't think we are putting enough emphasis on the carpooling. To me I think that's the greatest potential that we have for conservation and I think we ought to be really gearing up for it.

Tell me about the third engine though.

Dr. SAVITZ. We had initially—we had started the heat engine program with four contractors and then went out for competition and selected two, Ford and GM. The next year (fiscal year 1980) Congress appropriated an additional $7 million and instructed us to proceed with a third team.

We have continued our previous work with them and have extended an existing DOE contract.

Mr. ROYER. Do you feel that's a higher priority than some of these other conservation measures? What I'm trying to find is that although

Congress authorized the program and told you to do it, aren't there some higher priorities?

Dr. SAVITZ. I personally feel the decision could be made looking at two. But as I said earlier, even with the hybrid it is good to have some options to look at rather than one technology. We are not ready to make that decision.

With the additional money for the third turbine it remains to be determined whether that should be used for some more component development work to help with the other two engines or whether it should be used for something like a low cost, no cost campaign for promoting information on driver awareness—some of us feel we should put more emphasis and get more funds for telling the advantgaes of carpooling and how much it is going to save people in dollars and cents promoting driver awareness so that they can reduce their consumption 10 percent.

But within the present limitations and directions we are proceeding along with the third turbine.

Mr. ROYER. Do you have the same feeling I do? I see a conflict with our public transportation system and our carpooling efforts. Your transit operators don't seem to want to be that much involved in either helping run the carpooling program. Their main thing is to get people in public transportation and maybe this takes away from other efforts.

What are we doing to instill some cooperation with the people? I'm very supportive of public transportation. I think it is a must and I think we ought to develop it. But I think somehow we have to develop better coordination and cooperation with our transit agencies. And the theory that all studies seem to indicate would help us greatly in our overall energy and transportation program is carpooling.

Dr. SAVITZ. I think it also takes the top leadership, be it the mayor of the city or the Governors of the States, to help promote these ideas because under them are often the transit authorities and they can help to run carpool systems. They can also encourage the use of public transportation. Washington, D.C., is a good example in light of how well Metro has done. Ridership has been very heavy and we didn't have any pollution alerts in a very hot summer. It has been a very good system. Even though it has limited distances now, it has frequent service. I get concerned when I hear of service being cut down.

Mr. ROYER. I am not criticizing transit systems because the systems I'm thinking of have been very successful and have increased ridership tremendously, which is great.

The only thing I don't find is cooperation in helping run these carpool programs.

Dr. SAVITZ. I believe you need the city government.

Mr. ROYER. Are we doing anything about it?

Dr. SAVITZ. The Department of Energy does very little except put out information. The Department of Transportation, I think, through its grants to State agencies, gives funds to encourage carpooling through special lanes like the Route 395 into Washington and other approaches to State and local governments.

And so, DOT does give the... money to do that and has emphasized this work this year. They have put together a task force of private sector and public sector people to encourage more ridesharing and more public transportation use.

Mr. ROYER. OK, on the alternative fuel utilization program, how are we coordinating that with the new synthetic fuels corporation? It looks to me, in glancing through your report and hearing your testimony, that there could be some duplication.

Dr. SAVITZ. That new synthetic fuel corporation is just getting started, but they will be responsible for producing the new synthetic fuels. We see our role as the people to test out the utilization of these in transportation, so we will work very closely with them and they will help to provide material for the manufacturers and for various fleets to test out the fuel. There is established a group of automotive manufacturers and also oil company representatives who are developing and trying to implement a program so that the automotive companies will have access to the synthetic fuels to test the engine and likewise the oil companies will have the specifications that the automotive companies need as to fuel types for their engines. So all that is in the program.

Mr. ROYER. You don't see any conflict or duplication?

Dr. SAVITZ. No. I think having set this mechanism with the oil companies and automotive companies that the private sector will help. Knowing Dr. Sawhill—and he knows our program—he will not try to set up a duplicative effort here at all but will help to expedite it.

Mr. ROYER. You mentioned the driver energy conservation program, and I think that's certainly a good idea. Just what are we spending in that area? I don't suppose it is very much.

Dr. SAVITZ. The whole area of transportation systems utilization?

Mr. ROYER. The awareness program.

Dr. SAVITZ. About $690,000 is planned for fiscal year 1981.

Mr. ROYER. Where is that being done primarily? Is it in schools or where?

Mr. BERWAGER. It was initially set up at the Nevada test site in Mercury, Nev., and we started out by training fleet drivers. We have expanded that program to train instructors from both the public sector and the private sector. And our intention and the guidance we give them is information on how they can go back and establish their own driver training programs.

Mr. ROYER. Where would they be doing the training? In industry?

Mr. BERWAGER. Yes, in industry. For instance, the Maryland State Police have set up a program where they not only train at their various precincts their own drivers but also they train other people from public agencies of other city and county governments. We have had a number of private companies who have sent people to Nevada to receive the training and they have gone back and established programs for their own fleet drivers. This type of networking has been the basis of the program's success.

In fact the Arco drive for conservation which is a nationwide series of presentations on how you can drive your car efficiently, the expertise for that was established when Arco sent some people to the Nevada test site to receive the training.

Mr. ROYER. I just have one last question Mr. Chairman. At the very end of the report where we talk about the cooperative automotive research program, as I remember, we propose that some of this research activity be concentrated in NASA. I was just wondering what the progress has been with the program and do you think it is

a good idea that we do some of this research with NASA? What is your opinion on how we are progressing?

Dr. SAVITZ. On the cooperative automotive research reprogram, the CARP program, which is to be a fundamental research program, the current status is that Ford and Chrysler have now signed and agreed to participate. GM will also be signing. The Department of Transportation has in their proposed 1981 budget $12 million to initiate the Government's effort. They are probably planning to do most of their work themselves or through the National Science Foundation.

As I mentioned earlier, NASA has been doing some very good project management for us with the heat engine program and the Stirling. The whole automotive area has been very effective in being able to use their expertise to help further our heat engine programs. We think that is a very good arrangement.

Mr. ROYER. So you think the congressional intent to have them do these things in cooperation with your Department has worked satisfactorily?

Dr. SAVITZ. Yes, where they are working very closely with us.

Mr. ROYER. Thank you, Mr. Chairman.

I have a couple of other questions. On page 14 you talk about your market demonstration project for electric vehicles. What you didn't mention and one thing I want to bring up just briefly now—but I can assure you I will want to go into it in great depth when we get together early next year—is the schedule that was laid out in Public Law 94–413 and how you are doing in meeting the goals—not really goals—mandates which were set down in that public law.

On page 14 and at the top of 15 you mention the different things you are doing, but how does that measure up against the mandate set down in Public Law 94–413? I was wondering if you might discuss briefly your schedule as compared with that laid out in the public law and some of the reasons perhaps why you haven't kept up with those figures.

If you feel like you have to have more time or want to respond in depth to that in writing, that would be fine with me.

Dr. SAVITZ. We can respond in depth in writing.

[The information follows:]

INSERT FOR THE RECORD

NUMBER OF ELECTRIC VEHICLES
IN THE DEMONSTRATION

October 9, 1980

Question: On page 14 and at the top of 15 you mention about different things you are doing, but how does that measure up against the mandate set down in Public Law 94-413. I was wondering if you might discuss briefly your schedule as compared with that laid out in the public law and some of the reasons perhaps why you haven't kept up with those figures.

If you feel like you have to have more time or want to respond in depth in writing, that could be fine with me.

NUMBER OF ELECTRIC VEHICLES IN THE DEMONSTRATION

Public Law 94-413 as amended by Public Law 95-238 called out the following demonstration:

Fiscal Year	Number of vehicles to be added to the demonstration
1978	200
1979	600
1980	1,700
1981-1984	7,500

In the Market Demonstration Project, the Department has entered into cost-sharing contracts with Demonstration Site Operators with the private sector, Federal agencies, State and Local governments and universities. For FY 1978 and FY 1979, the number of vehicles under contract with the Demonstration Site Operators were 772. An additional 28 vehicles for the total of 800 vehicles were scheduled for a pilot demonstration of improved upgraded vehicles.

In accordance with Public Law 94-413, as amended, the Administrator (now the Secretary) is to inform the Congress on the basis of his annual review if he determines that the vehicles cannot be added to the demonstration.

On April 20, 1979, the Secretary notified the Congress by letter that for FY 1980 that the Department would only add 700 vehicles (compared to 1,700 called out in the Act) of which 200 would be "upgraded demonstration vehicles." The lower 500 number was based on the ability in early 1979 of the industry to supply vehicles with the capability of site operators to use them. The 200 upgraded vehicles were to be developed with improved batteries (nickel-zinc or nickel-iron) to accelerate the commercialization of new technology into the demonstration.

On April 24, 1980, the Secretary notified Congress by letter the Department was not in a position to provide the 200 upgraded vehicles. None of the battery manufacturers for nickel-zinc or nickel-iron batteries, after extensive development and testing, were willing to commit themselves to supply the quantities of batteries for a 200 vehicle demonstration at that time. The Secretary stated in the letter that the Department was accordingly revising the program and shifting resources to resolving near-term battery reliability, cost and identified engineering problems. Due to the escalation in vehicle costs due to inflation and vehicle improvements, the Secretary notified Congress he was shifting $1.5 million to maintain the level of 500 vehicles in the normal demonstration as previously planned.

In FY 1981, the President's budget request to the Congress includes $9.56 million to add 350 electric vehicles to the demonstration. It is to be noted that the House Appropriations Committee in their mark-up of the FY 1981 request recommended a decrease of $9.56 million by deleting funds for additional demonstration vehicles in fiscal year 1981. The Department strongly disagrees that "the current sites and vehicles are sufficient to evaluate vehicle performance and operational problems" as stated by the Committee. The Senate Appropriations Subcomittee on Interior mark-up recommended the President's request for the demonstration. Of these new demonstration vehicles, a limited number on the order of 10 will be equipped with advanced batteries such as zinc-chloride or nickel-iron. Since these batteries are being developed in small numbers they are relatively costly until mass produced and the vehicles are much higher in cost than the normal lead-acid batteries in the current demonstration.

The capability of the electric vehicle industry to produce vehicles has been very limited. There has not been the capability to produce thousands of vehicles per year of the quality and performance required for the demonstration site operatees.

To assist this emerging electric vehicle industry to expand their production capability, the Loan Guaranty Program was established by the Congress and implemented by DOE. The recent awards of loan guarantees to Electric Vehicle Associates and Jet Industries, Inc. will permit these firms to increase their production output. Thus, over this next year the capability to produce thousands of vehicles by this industry is developing. Without this capability the Department could not plan and request the quantities of vehicles called out in the Act.

In subsequent fiscal years, the Department plans on increasing the number of vehicles in the demonstration at a greater rate as the production rate of the industry is achieved. A limited number of advanced technology vehicles will also be placed in field demonstrations. As stated by the Secretary in his April 24, 1980, letter to Congress: "We remain fully committed to the rapid commercialization of electric and hybrid vehicles and will continually review the program strategy and progress."

I do acknowledge that we are behind schedule in the numbers of vehicles that we were going to procure according to that law as amended. We hope to be able to catch up in the next few years.

We will have by the end of fiscal year 1980 negotiations, almost 1,200 vehicles that will have been purchased. As a result of 1978 and 1979, 737 vehicles. The numbers are less than we had anticipated, but we can give it to you exactly for the record, what the law's schedule was and where we are in that schedule.

I think though even though the numbers are fewer that the performance we have been obtaining from these vehicles is very good and the reception given to it by the site operators is very positive and there have been relatively few problems. The people at GTE have said once it starts working they haven't had any battery problems or failures or exceptional maintance except putting water in the batteries.

So it is very successful though the numbers are not as high. As I said, we are evaluating that and hope in the next few years to catch up with the actual numbers.

Mr. HARKIN. The methane bill. I wonder if you will be requesting funds for next fiscal year for it when you come to see us in January or February or whenever we get together?

Dr. SAVITZ. The Department finished its action in August. We are currently having our discussions with OMB now. In fact, tomorrow the transportation program has their review. The bill was passed after we sent OMB our budget. That is one of the issues we plan to raise with OMB tomorrow.

Mr. HARKIN. But you do know of the widespread support it has on the Hill?

Dr. SAVITZ. Yes.

Mr. HARKIN. I would think that a request from you for funds would be met with with a great deal of support.

Dr. SAVITZ. Next year will be an even tighter budget year than 1981, and it is something that we will be discussing within the administration.

Mr. HARKIN. To tell you the truth, if we took $12 million out of that CARP program and put it in the methane program, we might be a lot further ahead. That's just my personal opinion for what it's worth.

Mr. Royer, do you have anything more?

Mr. ROYER. I have one more question I would like to pursue a little bit. It is referred to on pages 28 and 29 in the three areas where you are talking about aircraft fuel conservation and indicating that you are going to be doing a study during fiscal year 1981. It seems to me we've had studies on this with FAA and NASA and it has already even been demonstrated in Atlanta. Why are we doing more studies when we have had studies?

Dr. SAVITZ. The studies we are planning to do will be done with existing equipment in increasing air fuel efficiency as opposed to new equipment.

Mr. ROYER. What was that again?

Dr. SAVITZ. What we are planning to do with aircraft towing and airframe and engine maintenance is more geared to looking at increased utilization efficiency with existing equipment as opposed to inventing new equipment. We are working with the NASA people in this area to make sure we don't duplicate what they are doing.

Mr. ROYER. So there's no question in your mind that we are not duplicating what has already been done?

Dr. SAVITZ. Right.

Mr. ROYER. And there are some potential areas of benefit from those particular first two areas you talked about, the towing and also the airframe and engine maintenance procedures?

Dr. SAVITZ. Yes.

Mr. ROYER. What about the third one, concerning the FAA procedures and regulations on fuel efficiency?

Dr. SAVITZ. The same is true.

Mr. ROYER. The studies that have been done do not cover the total spectrum?

Mr. BERWAGER. There have been studies in each of these areas. Regarding towing and the engine maintenance, there were some initial studies done by FAA and NASA in the early seventies at which time the interest by the airline industry in these costs or fuel saving techniques was very much lower than it is now. Airline fuel has probably quadrupled in price over the intervening 6 or 7 years. We have gone back and relooked at some of that analysis with FAA and with NASA and are carrying out some fairly low cost projects jointly sponsored with the airline industry to pursue those conservation techniques within the airline industry concerned with FAA regulations. We have conducted a fairly low level effort to look at FAA programs and air traffic control regulations to identify those which we think should be seriously examined by FAA because of their energy consuming implications. FAA is, of course, primarily interested in safety.

Second, the FAA is interested in noise abatement. Energy conservation, while not ignored by FAA, does not have the priority the other two, safety and noise abatement, do. We are trying to assure that FAA gives serious consideration to the energy implications of their programs as they carry them out.

Mr. ROYER. Do we know for sure that we are not getting into a new full blown study duplicating efforts already made and are you coordinating that?

Mr. BERWAGER. Yes, sir, we can document that.

[The information follows:]

INSERT FOR THE RECORD

AIRLINE FUEL SAVING STUDY

OCTOBER 9, 1980

Question: Page 42, line 17, Mr. Royer.
Do we know for sure that we are not getting into a new full blown study duplicating efforts already made and are you coordinating that?

Mr. Berwager. Yes, sir, we can document that.

We have on file a letter from NASA's Engine Component Improvement Project Office expressing their interest in our engine maintenance program and offering their assistance to DOE during the latter phases of the project. Additionally, the FAA's Office of Energy and Environment is included as a project monitor/advisor on all DOE studies dealing with FAA regulations and procedures, providing DOE with written comments regarding study results and conclusions. DOE is sponsoring a two-day aviation conservation symposium next Fall to provide a forum in which Government agencies and representatives of the airline industry can exchange information regarding current activities and programs to conserve fuel. The FAA and NASA will be active participants in this symposium.

Mr. HARKIN. I just have one last question. We talked about the second Stirling team and the $5 million add-on. I'm just wondering can you state that the administration is supporting the $5 million add-on?

Dr. SAVITZ. When the House appropriated the $5 million we met and they did say at Office of Management and Budget that they did support it more as a technology support and development support as opposed to a full second team. As I talked earlier I do not support performing a full second team to meet the same schedules as team one, but do support the idea of needing more people involved in the technology development, the manufacturing ability, and power train development; I do support those aspects of development, but do not see a full second team that can meet the schedule and have major outlay commitments. I could see a consistent level of effort of $5 million for several years to build up this technology component and build up parts of industry to be able to handle it.

As I read the language in the House appropriations bill, it was an either/or or both, a second team or technology R. & D. that was stated in the committee report.

Mr. HARKIN. As you know, the Senate did not go along with the additional $5 million.

Dr. SAVITZ. The Senate switched it from the transportation program to our advanced conservation program and reduced the $5 million to $3 million and said it was also supposed to apply to stationary applications.

Mr. HARKIN. They put it in a different line item rather than just under automotive.

Dr. SAVITZ. Into what we call an advanced conservation technology line item.

Mr. HARKIN. Did you support that?

Dr. SAVITZ. Well, it would not do the same thing.

Mr. HARKIN. Does that track with what you were just telling me?

Dr. SAVITZ. It tracks only in that we support doing those types of things for transportation. What they have done is take $3 million to do Stirling technology for stationary and transportation. You can't do what you could do for $5 million in transportation for both transportation and stationary for $3 million. It is just not enough money. We can support doing $5 million of technology development for transportation type work. We can support additional money to look at stationary applications or industrial applications for Stirling engines, but their $3 million won't do—because it does include the stationary—but we support it as a technology development as opposed to a second team approach, if we mean the same thing by second team approach.

We have the three teams in turbine, Ford, Chrysler, and GM. We don't see competing with MTI as a second team being able to meet the schedules. But we do see the need for additional people involved with the technology development.

Mr. HARKIN. I was just curious why the Senate did that.

Dr. SAVITZ. So were we, because we have supported the $5 million in the House.

Mr. HARKIN. I was just trying to get it clear in my mind as to whether or not you had perhaps shifted some of your thinking, but you assure me you haven't?

Dr. SAVITZ. No, we have not, and in our future budget presentations we have taken into account what the House has done.

Mr. HARKIN. OK. Thank you very much' Dr. Savitz.

Dr. SAVITZ. I want to thank you and your committee for support of our program.

Mr. HARKIN. We have two demonstration cars down in the horseshoe drive.

The subcommittee will stand adjourned until next year, unless something drastic happens.

[Whereupon, at 10:50 a.m., the subcommittee was adjourned subject to the call of the Chair.]

[The prepared statement of Dr. Savitz follows:]

STATEMENT OF

DR. MAXINE SAVITZ

DEPUTY ASSISTANT SECRETARY FOR CONSERVATION

CONSERVATION AND SOLAR ENERGY

BEFORE THE

SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND COMMUNICATIONS

COMMITTEE ON SCIENCE AND TECHNOLOGY

U.S. HOUSE OF REPRESENTATIVES

SEPTEMBER 30, 1980

Mr. Chairman and members of the Subcommittee:

I appreciate the opportunity to appear before you today to report on the progress of the transportation programs in the Department of Energy.

The overall goal of the Office of Transportation Programs (OTP) is to conserve petroleum in transportation. Our progress lately has been unexpectedly rapid largely due to rising prices. For example, petroleum imports are down about 35 percent right now, compared to last year. Gasoline consumption for the first five months of 1980 is down about 8 percent from the same period last year. These results, which could be only temporary, are nevertheless encouraging.

There are encouraging signs for the future, too. There is a promising new battery, zinc-chlorine, being developed by Gulf and Western Corporation. Cummins Engine Company is developing diesels of greatly increased efficiency, using ceramics developed for the DOE gas turbine program. Highly efficient fuel cells applicable to passenger cars are being developed, stimulated partly by our electric vehicle programs. The major auto companies are trying hard to build more efficient cars and are becoming committed to building electric cars for sale.

The three approaches of OTP to accomplish its objectives are: (1) to develop more efficient equipment for the future, (2) to encourage the manufacture and use of nonpetroleum vehicles, and (3) to use today's transportation systems more efficiently.

Each of OTP's programs has specific objectives which will contribute to attainment of the overall goal. The objectives are based on legislative mandate, industry estimates, technology expectations, market assessments, and budgetary constraints.

In FY 1981, OTP is undertaking expanded program evaluations, including the development of an evaluation methodology that allows for tradeoffs among the project funded by OTP and alternative transportation projects based on the expected petroleum and energy savings that will result, as well as environmental, economic, and social impacts. When completed, these evaluations will provide the basis for the development of a DOE transportation conservation strategy that will establish measurable objectives by which goal achievement will be continually monitored.

To give a progress report of the current activities of OTP, I will describe the ongoing projects in each of the four program areas of the Office.

1. Automotive Technology Development Division

The basic goals of the Automotive Technology Development programs at DOE are to ensure that new energy efficient, environmentally compatible technologies for highway vehicles are developed to a state of readiness for evaluation and possible use by the automotive industry. The program's objectives also include the eventual commercialization of these technologies, if appropriate.

Mr. Chairman, as you are aware from past DOE testimony given on the Automotive Technology Development Program, the major focus of our ongoing activity in this area is the systematic development and demonstration of two advanced automotive heat engines, the Stirling and the gas turbine, since they offer high potential for future petroleum conservation, as well as multi-fuel capabilities. In recognition of the need to accelerate these activities, Congressional action was taken in 1973. Specific requirements of the Congressional mandate under Title III of PL 95-238, The Automotive Propulsion Research and Development Act of 1978, are as follows:

- o Develop and demonstrate advanced systems within 5 years
- o Supplement, not supplant, industry R&D
- o Establish new projects while accelerating existing areas
- o Intensify research in key areas
- o Give priority to fuel flexible systems.

Continued analysis is being performed, to determine whether other appropriate automotive technologies should be explored with Federal support, especially in light of the current financial health of the U.S. auto industry and increasing impact of foreign imports.

Two elements of the Advanced Heat Engine program, the gas turbine and the Stirling engine, have been elevated to the status of Major Systems Acquisitions (MSA). These projects are two of only 37 programs within the Department which fall into this category.

By this management action, continuous top level briefings with the DOE Controller and the Under Secretary are now being instituted, to assist in assuring program success. DOE top management has long recognized the conservation potential that the Heat Engine program represents, and is now taking a very active part in the program's major decisions.

In the past year, both the gas turbine and Stirling developments have progressed at a development rate which is on schedule and commensurate with normal technical risks. In the turbine area, two teams of automotive industry participants have been actively pursuing their individual concepts and have completed their MOD I engine designs.

The AiResearch/Ford team is pursuing a single-shaft turbine concept. The vehicle integration of the contract has shown that this engine can be configured in the latest downsized, front wheel drive Erica body style, which is being introduced this model year in the Ford Escort and Mercury Lynx and will be representative of a major portion of Ford's future production. Preliminary designs of the MOD II Ford/Garrett engine have shown a projected fuel economy on an EPA combined urban, suburban driving cycle that is 30 percent higher than the car using a conventional engine.

The General Motors team is at a similar point in their developments having completed the preliminary design of a twoshaft gas turbine. The vehicle integration tasks indicate that the engine and drivetrain can be accommodated in GM's latest X body, front wheel drive automobile. The program will demonstrate this capability in a 1982 Pontiac Phoenix. The MOD II engine has shown a projected fuel economy of 41.2 MPG on the EPA cycle. Significant progress has been made this year in the development of small gas turbine components.

Additionally, as a result of the FY80 Interior Appropriations Bill action adding $7.0 million for a third turbine development team, DOE has modified an existing Chrysler contract to include their participation in preliminary design of a third automotive turbine using a belt drive continuously variable transmission.

During the past year, the gas turbine program has been able to make some significant progress toward meeting its goals in the following areas:

- Initiated hot tests on ceramic parts at Detroit Diesel Allison for the 2070°F engine configuration of the Ceramic Applications in Turbine Engines (CATE) project. There parts included a ceramic plenum, gasifier turbine vanes and tip shroud assembly, ceramic bladed metal rotor and regenerators.

- o Demonstrated improvements in the Upgraded Engine performance (including combustor emissions, control system stability and turbine efficiency) and successful operation with two alternate fuels. These improvements resulted from the in-house effort at NASA/LeRC in support of the Advanced Gas Turbine (AGT) development.
- o Awarded major prime systems contracts to teams of AiResearch/Ford and Detroit Diesel Allison/Pontiac for the Advanced Gas Turbine Powertrain Development Project in early FY 1980. Initiated efforts with a third AGT team of Chrysler/Williams Research Corporation through modification to an existing DOE contract.
- o Completed initial Reference Powertrain Design and MOD I Powertrain preliminary design reviews of the AiResearch/Ford AGT on schedule. Fuel economy and performance predictions indicated the potential to meet contract goals.

The Stirling engine program is progressing extremely well. The Mechanical Technology Inc., United Stirling and AMC team has completed on schedule the MOD I engine design, and procurement of engine system hardware is well under way.

A national strike in Sweden has delayed by about 1 month the delivery of the first engine; however, it is anticipated that the first MOD I engine will start assembly testing in November 1980, and engine dynamometer performance testing will begin in February 1981. This is a significant milestone, since this will be the first Stirling engine designed and built specifically for automotive application.

The MOD II version of the engine, which has gone through preliminary design and vehicle integration studies, will be demonstrated in a 1982 GM X Body Oldsmobile Omega. Based on preliminary estimates, we anticipate that fuel economy on the EPA combined driving cycle will be 48 mpg (using diesel fuel).

6

More specific technical accomplishments have also been made in the past year:

- Hydrogen permeability (leakage) has been greatly reduced by utilization of a CO-CO_2 dopant in the hydrogen gas
- Over 4000 hours have been accumulated in P-40 engine tests at 830°C and 150 atmospheres representing MOD II conditions
- Combustion gas recirculation system tests have shown weight reduction and fuel economy improvements over exhaust gas recirculation systems presently used
- The new seal design has been successfully operated for over 3000 hours in engine testing

The Vehicle Systems Program is continuing work on improving present day and advanced vehicle systems. The organic Rankine bottoming cycle development (waste heat recovery) has been demonstrated in a Class 8 Mack truck for one year with a consistent showing of a 10 percent improvement in fuel economy over a conventional diesel driven truck.

Design and laboratory testing (1000 hours) of second generation bottoming hardware has been progressing concurrently during the past year. The emphasis of this equipment is to reduce the packaging difficulties of the prototype design (first generation).

Turbocompound heavy duty diesel has also completed one year of operation in revenue service between Florida and California, accumulating over 50,000 miles. Results have shown a 5 percent improvement is easily attainable with this waste heat recovery equipment. Cummins Engine Company, contracted to supply this system, is presently looking at downsizing engine horsepower and manufacturing a turbocompound system in the mid 1980's.

Other vehicle system activity that has led to significant accomplishments in the past year includes:

- Continuation of regular revenue service of gas turbine-powered Greyhound buses, including the addition of three more buses bringing the total to four. Plans are underway to incorporate alternative fuels in this demonstration next year.
- Completion of a gas turbine installation on a urban bus (RTS-II) and initiation of revenue service in the city of Baltimore. Road tests and shakedown have been completed. This five-bus demonstration project will have the capability of field testing ceramic engine parts as they are developed in the automotive gas turbine development program.
- Final data acquisition of the 400 GSA fleet Pintos equipped with a controlled speed accessory drive. Over the year, under varying ambient conditions, fuel savings of 6 to 8 percent were achieved. Automotive manufacturers will probably offer a system using similar technology in their 1983 model year automobiles.
- An automatic flywheel engine shutoff and restart system was manufactured and installed in a test vehicle under contract to Wallis Motors. Fuel economy and emissions tests are now under way, and fuel economy improvements of between 10 percent to 30 percent are expected, depending on the driving cycle. Several automobile manufacturers are scheduled to introduce this technology in the 1981-1982 model years.

2. Alternative Fuels Utilization Program

The goals of the Alternative Fuels Utilization Program (AFUP) are to assess and if appropriate, achieve commercial technical readiness of alternative fuels for transportation through understanding and solving the problems associated with upgrading crude supplies and then matching them to appropriate engines. The fuels under consideration are synthetic gasoline and distillates from oil shale and coal, alcohols (methanol and ethanol) used straight or blended with gasoline, advanced fuels such as hydrogen and hybrid nonpetroleum/petroleum blends, and emerging fuels. DOE's major emphasis is on the use of these fuels for automobiles, trucks and buses. Some of the potential barriers to the use of these alternative fuels relate to environmental, health and safety constraints.

Society has become so accustomed to the convenience and benefits of fuels like gasoline that these fuels are taken for granted. However, the formulation of finished petroleum fuels is a highly complex and sophisticated business. Each refinery is somewhat unique in that the crude oil feedstocks, processing, and output product mix is different for each. Further, the proportions of the product mix must be adjusted to accommodate seasonal changes in petroleum demand, such as a greater need for heating oil in the winter months. The crudes from oil shale, coal and biomass are different from petroleum crudes, yet they, too, must be converted to useful forms in a balanced, effective and economical manner. The engineering techniques and tools are largely empirical and have been developed over decades. They work well for petroleum, but it is not yet known whether they will equally, or even adequately, apply to new fuels. It is issues such as these that are a focal point of the AFUP, so that whatever supply technology is used, the output can be converted to useful forms.

The most likely alternative fuels possibilities for use in conventional engines are alcohol/gasoline blends and gasoline-like fuel derived from coal and oil shale. However, essentially straight alcohol fuels could be used in modified versions of today's engines in a more efficient way than in blends, and an optimized process/fuel/engine match can far more effectively use coal and oil shale than by making products which are optimum for petroleum.

Significant accomplishments of the Alternative Fuels Utilization Program are outlined below:

AFUP personnel played key roles in two international activities related to alcohol fuels. First, the Fourth International Symposium on Alcohol Fuels Technology will be held in Brazil in early October as follow on to earlier ones in California, Germany and Sweden. This presents an interactive forum for several hundred researchers whose cooperative exchange has significantly hastened development and commercialization of alcohol fuels throughout the free world. Second, groundwork for an IEA agreement on alcohol fuels technology has been completed that will finally provide for formal supplementation of the above work through associated governmental bodies.

Laboratory tests of 100 percent methanol and ethanol fuels have been completed which can serve as the basis for design of an optimized commercially oriented vehicle. Continuing work on the use of straight methanol now involves operation of a fleet of ten automobiles using several fuel management systems. These techniques go beyond those being commercially used in Brazil, and provide the basis for achieving U.S. needs, which are more complex due to factors such as emission regulations. Activities on alcohol/gasoline blends have been accelerated at the same time and include both engineering and field reliability fleet tests that will lead to commercial readiness of fuels that go a step beyond gasohol.

The reliability tests will involve about 825 vehicles operated on engineered blends using a nominal 10 percent volume alcohol and a comparable number of vehicles operated on gasoline to serve as a reference. Both ethanol and methanol will be used. In essence, these fuels are advanced compositions as compared to the presently marketed gasohol (10 percent ethanol mixed with typical 90 percent unleaded gasoline), and are aimed at providing very high reliability under broad climatic conditions. Tests involve cooperation and close support of the automotive and fuels industries.

The major effort in alcohol fuel reliability testing will continue in FY81. Controlled fleet vehicle testing on engineered methanol/gasoline blends will be completed. Feasibility investigations on the practicality of using ethers from coal in alcohol blends will also be completed in FY81.

In parallel with the efforts on alcohols, technical activities in the area of synfuels and hydrogen will continue. A major assessment of the technical issues, and resource economics of using gaseous fuels such as methane, will also be completed.

In solvent refined coal processes (both SRC-I and SRC-II), a substantial portion of the liquids produced are phenols. Phenols have characteristics which make them unusable as fuel. An AFUP project shows that simple conversion of these to ethers using established technology results in a good fuel extender for gasoline. This finding may also have a substantial beneficial impact on SRC plan designs.

One of the characteristics of distillates from shale oil is a tendency to form wax crystals at low temperatures, thus causing problems with vehicles operating

in cold climates. One AFUF project just completed was the first to address development of finished fuels from synthetic crudes. The project investigated and demonstrated the practicality of using flow improver additives to achieve low temperature flow property specifications similar to petroleum-derived diesel fuels. This activity is but one of a great many required to assure that fuels (including alcohols) from biomass, coal and oil shale can be effectively, efficiently and reliably used in transportation propulsion systems.

A project was initiated earlier this year to evaluate a wide range of fuels representing shale and coal-derived fuels in internal combustion engines that represent five different combustion chamber designs. This aims at identifying the first generation approach to an optimized synfuel/engine system. Compared to making gasoline from coal, such an optimized system could save from 1/4 to 1/2 of the coal feedstock required per vehicle mile traveled.

In summary, the Alternative Fuels Utilization Program is involved in underlying technology to prepare the transportation sector for a nonpetroleum future.

3. The Electric and Hybrid Vehicle Program

The Department's Electric and Hybrid Vehicle Program is designed to reduce the Nation's dependence on foreign sources of petroleum by encouraging the expeditious introduction of electric and hybrid vehicles into the transportation fleet. The goal of the program is to evaluate and if appropriate, accelerate the commercialization of vehicles that use electricity as the principal source of propulsion energy and thus provide fuel flexibility for the transportation sector. The basis for the program is Public Law 94-413 as amended by Public Law 95-238 legislation that originated in this Committee.

Since our presentation to the Committee last year, there has been increased interest and public awareness in electric vehicle due to rising fuel costs and concern over the availability of petroluem. General Motors and Gulf and Western have announced their intent for serious development effort and commitment to production of electric cars and batteries. Although both companies have stated that a number of milestones must be attained before introduction of electric cars and the new battery to the consumer, the activities of the two companies represent a serious effort to commercialize electric vehicles.

On September 5, Globe Union publicly announced that it will begin commercial production of a new lead-acid battery, the Globe EV-1000 for electric vehicles. It is the same battery that they designed for the Department's Near-Term Electric Vehicle, the ETV-1.

The demonstration program is also making progress in assisting industry decision makers on the economic viability of electric vehicles in fleet operations. General Telephone and Electronics (GTE), one of the cost-sharing site operators in the Department's demonstration, is putting 75 electric vehicles in operation at three different locations. In addition, GTE is negotiating with DOE to place additional vehicles at new locations across the country. Cliff Hayden, the Energy Director for the GTE Corporation, has this comment to make: "It is my considered opinion based on the knowledge gained to date from the DOE Electric and Hybrid Demonstration Program, our projections of future liquid fuel costs coupled with fuel uncertainties, that the electric vehicle can be economically justified at a selling price approximately 1 1/2 times the cost of a comparable internal combustion vehicle."

The strategy and planning of the Department's EHV Program for the commercialization of electric and hybrid vehicles is beginning to show tangible results. Research and development programs are leading to new products being committed to commercial production by industries such as Globe Union and Gulf and Western. Demonstrations by fleet managers such as GTE are developing operational data that electric vehicles are an economically viable alternative.

To achieve the ultimate goal of commercialization of electric and hybrid vehicle technology, the Department's program has been focused on five projects to accomplish specific objectives (as reported to the Congress in our Tenth Quarterly Report in May 1980). A brief description and accomplishments of each of these projects are given below

Market Demonstration Project

The purpose of this activity is to identify, test and expand electric and hybrid market sectors, and to develop the necessary support infrastructure to maintain vehicles in practical operations. Allow me to mention a few of the past year's accomplishments:

- Since 1978, the first year of Demonstration, production capability has increased by a factor of eight; one manufacturer is now producing 60 vehicles per month.
- Demonstration site operators, interacting with manufactures, have caused significant improvements in electric vehicle performance, safety and reliability.
- Demonstration vehicles are traveling more than 100,000 miles a month.
- Based on cost-sharing agreements initiated by site operators involving themselves, manufacturers and DOE, five vehicles with advanced batteries such as zinc/chlorine are being contracted for in FY 1980, and up to 10 in FY 1981.
- Although negotiations are not complete at this time, nine additional subcontractors have been selected in the private sector and two current site operators have increased their electric vehicle fleets. The latter two site operators believe that current electric vehicles have the potential to replace between 25,000 to 45,000 gasoline vehicles in their fleet operation.
- The new private sector partners in the cost-sharing ventures include taxi operations in New York City, dealer type operations in New Jersey and Colorado, major airlines and others.
- Federal agency operators have been increased by five, including the Solar Energy Research Institute, which intends to set up a solar charging system for its electric vehicles. The military participants have indicated that they believe they can use about 3000 electric vehicles over a period of several years.

- State and local government participants have increased from 10 to 22; and more than 850 new requests for applications have been received for participation in FY 1981.
- Once negotiations are complete with companies selected in the private sector, some 75 cost-sharing site operators will be involved at 97 different locations. One company alone will have 185 vehicles at 10 locations.
- The Demonstration is expanding the market, defining and resolving barrier problems on a local basis, developing support systems necessary for a market which can ultimately allow production at levels offering economics of scale, and improving the product based on practical use of electric vehicles in real work mission situations

Incentives

The purpose of the EHV Loan Guaranty Program is to assist manufacturers in obtaining the necessary capital for commercial production of EHV's.

- A loan guaranty was awarded to a manufacturer of electric vehicles, Electric Vehicle Associates of Cleveland, Ohio, representing a 97 percent guaranty of a $2.5 million loan ($2.425 million).
- A conditional commitment to guaranty a $3.0 million loan was issued to another EV manufacturer, Jet Industries Inc., of Austin, Texas.
- During FY 1980 two additional applications for guaranties of loans were submitted, making a total of four active applications on hand totaling $9.6 million.
- Six project summaries totaling $11.5 million were received in 1980. (One firm has also submitted an application.)

As an incentive to the major auto manufacturers, Congress passed legislation in January 1980 to permit the use of an equivalent MPG for electric vehicles in the Corporate Average Fuel Economy. A proposed rule for the method for calculating the electric vehicle MPG equivalent was published in the Federal Register on May 21, 1980. The final rule is scheduled for December 1980 completion.

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Vehicle Evaluation and Improvement (VEI) Project

The objective of this project is to develop improved vehicles through optimization of off-the-shelf technology and to aid the rapid commercial availability of these vehicles. The VEI Project achieves this objective by assisting existing manufacturers in upgrading their vehicles through product improvement contracts, by continuously assessing the State of the Art through test and evaluation of available vehicles and components, by setting minimum performance standards vehicles must meet or surpass to participate in the Government sponsored Market Demonstration Project, and by assessing the need for technology improvements. Accomplishments of the VEI Project over the past fiscal year are as follows:

- The vehicle performance standards required under the provisions of the Public Law 94-413 were revised and published on February 12, 1980. These standards are effective for all vehicles acquired in fulfillment of contracts entered into after March 13, 1980.
- Verification testing was completed on six electric vehicles presently in use by DOE demonstration site operators.
- Eleven additional vehicles procured under the product improvement activity of the VEI Project were delivered for testing. Six of these vehicles will enter a field test program being conducted by the Tennessee Valley Authority.
- Completed an investigation of the potential hazards associated with gases released as a result of recharging lead acid batteries. The results revealed that the concentrations are well below the OSHA established threshold limit values.
- Initiated an activity to develop an air conditioning unit suitable for use in an electric vehicle utilizing existing off-the-shelf components.

Electric Vehicle Commercialization Project

The purpose of this project is to induce mass production by 1986 of cost-competitive electric cars that will be acceptable to a broad segment of the market; and also to provide expanded technological options to the EV industry. Technologies under development for commercialization in the mid-1980's include near-term batteries such as nickel-zinc, nickel-iron, lead-acid and zinc-chloride; propulsion systems and components, and vehicle systems such as the ETV-1 developed by General Electric and Chrysler Corporation. In addition to technology development, this project includes market analysis, production engineering, and other commercialization activities. Accomplishments during the past year include:

- Testing of experimental nickel-zinc, nickel-iron and lead-acid battery modules at the Argonne National Laboratory National Battery Test Lab (which became operational last year) have indicated achievement of the 1980 goals in energy, power and life.
- The ETV-1 experimental electric car by General Electric and Chrysler has been accepted and testing is under way at the Jet Propulsion Lab; testing with other batteries from the near-term battery program will commence shortly with the ETV-1 as well as other vehicles. Testing of full-sized experimental nickel-iron and nickel-zinc batteries with the South Coast electric Rabbit were completed and demonstrated improved performance, including a 30 to 80 percent increase in range over the currently available electric Rabbits.
- Installation of a zinc-chloride battery in an electric vehicle is well under way by Gulf and Western's EDA Corporation. Testing of the vehicle by DOE is scheduled for the near future.

- The first proposal of a formula for the inclusion of electric vehicles in an auto manufacturer's corporate average fuel economy has been developed and published in coordination with the Environmental Protectio Agency and Department of Transportation under the authority of Public Law 96-185, the Chrysler Corporation Loan Guarantee Act. We are taking the necessary steps for publication of a final rule in the first quarter of the next fiscal year.
- A one-of-a-kind facility for programmable testing of electric and hybrid vehicle propulsion systems/components, called the Road Load Simulator, became operational and is enhancing our low cost, high quality testing capabilities. The Road Load Simulator is an important tool for evaluating various competing concepts and for determining which options are most promising for continued development. In a cost shared contract with the Eaton Corporation the development of an alternating current (a.c.) propulsion system through breadboard has been completed and will be delivered this month for testing. The a.c. motor has cost and maintenance advantages over direct current systems.
- Exploratory discussions with the major automotive firms have been held with respect to the potential for future mass production of electric cars.

Hybrid Vehicle Commercialization Project

The objective of this project is to stimulate the commercialization of a hybrid powered car by the late 1980's that will have a range and acceleration performance equivalent to conventional vehicles but with a 40 to 70 percent reduction in fuel consumption. This project brings together all of the previous, current and planned hybrid related studies and development activities. These activities include the Near Term Hybrid Vehicle Development Program, the hybrid propulsion component development work and a new battery development activity that will be initiated in fiscal year 1981.

- Phase I preliminary design studies for the Near Term Hybrid Vehicle Development Program were completed by four contractors. General Electric was selected to continue into the Phase II vehicle development. GE will build two hybrid integrated test vehicles for delivery in the Spring of 1982. These vehicles are intended to demonstrate the potential for a petroleum savings of 40 to 70 percent over conventional vehicles of equivalent size and performance.
- System design and specifications for the GE Hybrid Test Vehicle have been completed.
- Advanced hybrid propulsion system studies, completed by three contractors, identified propulsion systems that would be suitable for five different classes of vehicles utilizing technology that could be developed by the mid-1980's.
- The initiation of an activity to develop a standard test procedure for hybrid vehicles. This work is being coordinated closely with the Environmental Protection Agency and the Department of Transportation because of their respective roles in establishing emission and fuel economy standards.

Advanced Vehicle Development Project

The objective of this project is to develop, by the early 1990's, a general purpose electric or hybrid vehicle completely competitive with internal combustion engine vehicles and requiring no petroleum for operation. For use in this advanced vehicle development project, DOE has defined an "advanced vehicle" to be either an electric vehicle or nonpetroleum hybrid vehicle or other nonpetroleum electricity based system, including fuel cells and those with two or more power, fuel, or energy storage devices. A number of advanced technologies in various stages of development under DOE support have potential to greatly enhance the capabilities or costs of electric or

hybrid vehicles to provide full performance vehicles. Candidate technologies include metal/air batteries, fuel cells, high temperature batteries, inductive coupling to electrified roadways and flywheels as well as dual fueled hybrids employing alternate fuels and advanced heat engines. The following are highlights accomplished this year:

- The ETV-2 high speed flywheel/battery powered car with the body and chassis of composite material, an advanced vehicle built by Garrett AiResearch Company, has been accepted at JPL and is currently undergoing characterization testing. Tests by Garrett have verified the high acceleration capability of the propulsion concept.
- Functional models of an advanced direct current brush type motor and a brushless electronically commutated disk type motor have been completed and testing is under way to verify the performance, cost and weight improvement potential of these advanced concepts.
- Technology fabrication for dynamic testing of inductive coupling to electrified roadways has nearly been completed by the Lawrence Livermore Laboratory and dynamic tests will be conducted next year to fully characterize the system. Due to the transportation system and multiple applications aspects of this concept, this work is being conducted in cooperation with the Department of Transportation.

The Annual Report and Quarterly Reports, with more detailed description of the progress of the EHV Program, have been forwarded to the Congress. The most recent Quarterly Report covering the period April through June 1980 has just been published and is available at this hearing.

4. Transportation Systems Utilization

The Transportation Systems Utilization Program includes the Department's activities to foster the acquisition of the most efficient transportation equipment available in the marketplace and the operation and maintenance of vehicles and equipment in a manner that maximizes energy efficiency. The program goals are to reduce consumption in the near-term to levels consistent with the National goal of reducing our dependence on imported petroleum. In late 1979, for example, a 1980 national gasoline consumption target of 7 million barrels per day was established. So far this year, the target is being achieved. This is a result of many factors, including higher gas prices, unprecedented consumer demand for fuel efficient new cars, and greater awareness among motorists regarding means for reducing gasoline use. For the mid-term (circa 1990), the goal is to reduce transportation energy consumption to levels 10 percent below projected consumption levels. A final goal is to prepare the transportation sector to deal with conditions that would accompany supply disruptions.

Program emphasis is determined primarily by the level of potential and expected energy savings. Because automobiles and light duty trucks are responsible for about one-third of the Nation's petroleum consumption, encouraging the purchase of efficient cars and light trucks and providing information to motorists on how to best maintain and operate their vehicles has received high priority. Making use of the empty seats in these vehicles through effective ridesharing promotion is another way of making a significant dent in gasoline consumption and DOE is working with DOT in that area. Because commercial trucks and buses consume about 2 million barrels of petroleum per day, we have been active in developing and disseminating information for motor carriers.

The Systems Utilization Program also includes a wide variety of outreach programs, and some research and development activity, aimed at nonhighway

transportation. While the marine, rail, air, and pipeline operations consume less petroleum than highway, they consume about 2 million barrels of petroleum per day which, for example, is more than that consumed by all of the Nation's electrical generating plants.

The target audience of this program includes motorists; commuters and other travelers; operators of highway vehicle fleets, aircraft, marine vessels and terminal facilities; State and local agencies having transportation or energy responsibilities; employers; associations and civic groups; shippers; and the manufacturers of transportation equipment.

By working with groups such as these, and with other Federal agencies, including the Department of Transportation, we are making steady progress in reversing the historic trend of the transportation sector to increase its petroleum consumption. In 1979, for the only time except for the embargo year of 1974, transportation petroleum consumption actually dropped by 4.15 percent. Through the first five months of this year, demand dropped by an additional 8 percent. While much of this reduction would have occurred in the absence of our programs, I feel they are making an important contribution to contributing to reducing the Nation's petroleum consumption and helping the public and business reduce the impacts of higher fuel prices. I would like to mention some of the specific system utilization programs.

The Fuel Economy Information Program helps the new car buyer choose the most efficient automobile that serves his needs by providing comparable automobile fuel economy information. Approximately 16 million copies of the Gas Mileage Guide are printed and distributed annually. In response to this year's evaluation survey of the Guide, changes have been made to improve the overall presentation of the data in the Guide, including reformatting the fuel economy information to increase its utility and impact.

The distribution system has been devised to provide delivery of the Guide to approximately 29,000 new car dealers; who, in turn, are required by law to make them available to consumers in the market for a new car.

The Driver Energy Conservation Awareness Program provides automotive fleets and the general motoring public with information on conserving fuel in their everyday driving operations. Program activities include transportation conservation quarterly newsletters, regional workshops, nationally distributed materials for use with the movie, slide and tape audio visual show, driving techniques research and development and testing of driver feedback devices, which will enable the motorist to personally determine the most fuel and cost efficient driving tactics and strategies. Recent accomplishments include:

- o An award winning movie, "Running on Empty," has been shown to thousands of community, business, and educational groups, and on telecasts that have been seen by nearly 20 million viewers.
- o This year the Driver Energy Conservation Awareness Training (DECAT) program and a series of Teach-Ins held in major cities around the country were featured as part of the White House Energy Efficiency Conference initiated by the President on April 29, 1980. That initiative, paired with accelerated program activity over the past year, has resulted in:
  - 600 requests by private industry for information on the DECAT program.
  - Over 2,000 mailings of reproducible program material to organizations for their internal transportation conservation programs and distribution to the public.
  - Training of over 1,000 Teach-In participants in eight major population centers in the U.S. on establishing gasoline conservation training programs for their organizations and constituents. (Two additional events are planned.)

The DECAT program has graduated nearly 2,000 drivers from its driving/classroom course and has developed over 250 new instructors from the public and private sectors. These new instructors are initiating DECAT programs in different localities across the Nation, resulting in a dramatically multiplied effectiveness of the DECAT program.

There are many programs now in place at the State and local level that are the result of attending the DECAT instructors course. For example, in May of 1979, the Maryland State Police (MSP) sent three instructors to the DOE DECAT instructor course in Nevada. They studied with our DECAT instructors for three days and returned to Maryland to set up their own course. They in turn trained 50 instructors within their state police force, at least one in each organizational unit. These instructors then trained all the officers in the force for a total of 1200 trained drivers. Additionally, the instructors have trained instructors from twenty-two states and many counties who have returned to their locales and conducted DECAT.

Colonel Thomas Smith, Commander of the Maryland State Police, has estimated that the MSP will save 14 percent of their fuel due to implementation of this program. In effect, the program will have paid for itself within the first few months of operation and the savings will accrue continuously. Historically, the MSP consume about 3 million gallons of fuel annually, and as a result of their DECAT program, have projected a 1980 savings of over 250 thousand gallons of gasoline. (This 1980 figure is less than 14 percent because many personnel were not trained until well into the calendar year.) This reduction in gasoline cost of $300,000 1980 was achieved at a program cost of $10,000 for expenses and outfitting training vehicles and $15,000 for materials development, printing and distribution, much of which is used in outreach activities to non-MSP audiences. This results in a return in the first year alone of more than $10 for every dollar spent. This benefit/cost ratio will increase substantially as the start-up costs are amortized over the program's life.

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The Voluntary Truck and Bus Fuel Economy Program is an effort to improve the fuel use efficiency of commercial vehicles. Since the program's inception, it has acquired over 300 members from industry consisting of motor carriers, manufacturers, component suppliers, trade associations, labor unions, and the trade press, as well as 20 State Energy Offices. Accomplishments to date include:

- A fuel economy exhibit has been developed for display at industry trade shows.
- Seminars on market fuel efficient technology to small trucking firms and owner-operators conferences have been conducted in truck dealer showrooms in the South, Northeast, and Midwest regions of the country.
- A quarterly newsletter, "Fuel Economy News," has been developed and distributed featuring articles on industry conservation efforts and updates of new truck and bus fuel economy technology. Circulation of the "Fuel Economy News" is presently 3,000.
- Slide presentations, movies, and publications containing information on ways to increase trucking and busing profits by reducing fuel consumption have been disseminated to the industry.

Ridesharing in the United States has an excellent near-term conservation potential. The Department of Energy and the Department of Transportation are working cooperatively in the promotion and advancement of commuter carpools, vanpools, and mass transit. The DOE program is concerned with the development of vanpool and carpool programs in the Federal Government, technical assistance to State and local authorities, and the use of ridesharing as an effective conservation contingency measure. Accomplishments during the last year include:

- Conduct of 20 ridesharing workshops for Federal Employee Transportation Coordinators.

- Publications to assist vanpool initiation: "Vanpooling....An Update" and "Starting a Driver Owned and Operated Vanpool."
- Establishment of vanpools as Priority One users under the gasoline allocation plan in periods of severe shortages (Special Rule No. 9 of Subpart A, Part 211 of ERA regulations). Vanpool operators with access to bulk gasoline storage tanks can obtain a new fuel allocation, or an increase in an existing fuel allocation. Also, each State, through the authority of the governor or legislature, may take the necessary steps to assist vanpool operators in obtaining gasoline at retail gas stations.

The New Concepts Evaluation Program is a program devised to tap the reservoir of innovative transportation energy conservation concepts that may exist within individual inventors, small businesses and academia. Many new transportation concepts have been submitted and evaluated, and a small number have been tested. For example, as a result of one such evaluation, a variable orifice-sonic carburetor is being tested in a Government laboratory. More than 100 unsolicited proposals have been evaluated by the Office of Transportation Programs to date.

The Nonhighway Transportation Systems Program is concerned with developing and commercializing conservation technology for the marine, pipeline, and railroad modes of transportation. Studies of the energy use and conservation opportunities have been completed for each non-highway mode. Selected conservation R&D projects include:

- An alternative fuels test program for medium speed diesels used by railroads and inland waterway vessels. Tests were successfully completed using broad specification diesel fuels, methanol-diesel dual fuels, synthetic shale derived fuels and Solvent Refined Coals (SRC II).

- Completed the design and assessment of the application of Organic Rankine Bottoming Cycles to marine diesels and initiated procurement action to establish an industry-government cost shared demonstration.
- Technical reports were published including "Alternative Energy Sources for Nonhighway Transportation," "An Energy Study of the Marine Transportation Industry," and "Energy Study of Railroad Freight Transportation."

Outreach activities included the development, publication and distribution to 8,000 users of "A Shipper's Guide to Energy Conservation." Additionally, an analysis of the net impacts of proposed regulatory changes on energy use by trucks and railroads has been conducted by the Department, and we have supported the regulatory modifications for 1980.

Intercity passenger activities recently supported have included an examination of commercial aviation operational energy conservation strategies and an analysis of transportation alternatives for mobility and energy savings. We have studied the feasibility of aircraft towing as an energy conserving method, the effect of FAA regulations and procedures on fuel efficiencies, and the potential of telecommunications to conserve energy and are pursuing programs seeking conservation through improved airframe and engine maintenance procedures. These efforts are expected to lead to selected demonstrations and further investigations in the coming year.

Under provisions of the Emergency Energy Conservation Act of 1979, OTP has developed the methodology for establishing State gasoline conservation targets. We have issued voluntary targets to each State for all four quarters of 1980. The purpose of this was both to familiarize the States with the methodology and the data base used in developing the targets and to impress upon States the need to reduce

gasoline consumption below levels originally projected for 1980. Also, in accordance with the provisions of the Act, we have developed the transportation components of the Standby Federal Emergency Energy Conservation Plan, and have participated in the public hearings held on the proposed measures. As a part of our program to asist the States in developing effective conservation programs, we have supported the development of a Director of Regional, State and Federal agencies and individuals active in the transportation energy conservation field.

The Analysis and Assessment Program assists the entire Office of Transportation Programs to carry out effective conservation programs tailored to fit end use markets. Projections of direct energy consumption by mode, and of energy savings and petroleum savings by each competing technology and strategy program have been prepared. These projections are based on extensive data analysis and information of future trends in the world and United States economy. Recent accomplishments include the publication of the Transportation Energy Conservation (TEC) Data Book (currently, Edition 4, September 1980) and the Regional TEC Data Book (April 1980). The latter compiles data and energy use detailed for the ten Federal regions, States and selected metropolitan areas, and highlights the variations that exist across regions with regard to gasoline used for vehicles, auto stock, light truck use, ridesharing, etc., for numerous specific transportation program areas.

A technology assessment of electric and hybrid vehicles is being made to determine a prediction of their market penetration and their impacts on various industries and the consumer. Included in this assessment are predictions of the demand for materials and pollution effects. A similar impact assessment of alternative

fuels has determined the tradeoffs of various alternatives for petroleum with respect to competition in the transportation sector.

To meet DOE and National Environmental Policy Act requirements, an Environmental Development Plan is updated annually. It defines and schedules research needs, environmental assessments, and environmental impact statements, through 1986. Specific Environmental Assessments have been prepared, and one on the Electric and Hybrid Vehicle (EHV) RD&D Program is to be published in November 1980, following one on EHV inclusion in the Corporate Average Fuel Economy Standards, May 1980.

The Systems Utilization Program will continue these types of projects in 1981 and plan additional activities in the area of program evaluations. The evaluation will involve the development of an evaluation methodology that will allow projects to be ranked in order of priority and will assist in choosing new projects as circumstances change. The intent of the detailed evaluations is to determine potential conservation efficiency and market penetration and to monitor actual progress of this potential.

In FY81, emphasis will continue to be placed on the development and assessment of contingency planning measures in support of the Emergency Energy Conservation Act and the development of methodologies for State conservation target setting for gasoline and perhaps other mobility fuels. Associated with the contingency planning program will be a continuing State and Local Transportation Conservation Technical Assistance Program designed to effectively transmit conservation information and stimulate State/local/regional activity. In addition, demonstration programs for organic rankine bottoming cycle application to marine diesels and the towing of commercial aircraft at airports will be initiated, continued research testing into the application of alternative fuels to medium speed diesels (railroad/marine) will

be conducted, and new project concerning conservation in freight intermodal operation and marine transport will be initiated. Approximately one fifth of the funding for these programs will be provided by Transportation Programs. The remaining portion will be principally supplied by the Office of Emergency Programs.

Transportation Systems Utilization also plans in 1981 to:

- Increase DECAT capacity by 33 percent
- Establish state level workshops on implementing transportation conservation programs
- Commercialize feedback devices for retrofit and new automobile market
- Distribute new vehicle purchase data to fleet purchasers
- Expand truck dealer and truck stop information program
- Implement the updated marketing/outreach program for expanding outreach to truckers other than major fleets
- Increase Gas Mileage Guide dissemination by 4 million copies
- Conduct program evaluations on Driver Efficiency and Truck/Bus programs

On May 16, 1979, President Carter met with leaders of the automotive industry at the White House and announced an effort by industry and Government to establish a Cooperative Automotive Research Program (CARP). Under the auspices of CARP, a basic research program would be initiated applicable to the auto industry. The Department of Energy, including the Office of Transportation Programs, is participating in the technical planning of this effort.

In summary, the activities of the Office of Transportation Programs cover a broad spectrum of programs that are structured to conserve energy and reduce petroleum dependency in the near-term (to 1985) and mid-term (to 2000).

That concludes my testimony, Mr. Chairman, and I would be happy to answer any questions that you may have at this time.